IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants	:	Charles Guthrie et al.
Serial No.	:	09/818,092
Filed	:	March 26, 2001
For	:	High Intensity Light Source
Examiner	:	Benny T. Lee
Group Art Unit	:	2817

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

DECLARATION OF GREGORY ALAN PRIOR
UNDER 37 C.F.R. § 41.202(a)

I, Gregory Alan Prior, declare:

1. I am a resident of the State of California, having a home address of 2814 Glen Heather Drive, San Jose, California 95133.

2. I make this declaration to describe my participation in the development of the invention described and claimed in the above-identified patent application.

3. I was Vice-President of Engineering at Digital Reflection, Inc. ("DRI"), where I was employed from October 1997 until March 2002. I was responsible for all aspects of the engineering development of DRI's LCOS (Liquid Crystal on Silicon) high definition television system, including the optics, electronics and mechanical

aspects of the system.

4. DRI's mission was to build an entirely new television system, from the lamp to the screen. Initially, we investigated using short arc lamps as the light source for the display. We soon turned our attention to plasma lamps, and investigated integrating a plasma lamp developed by Fusion Lighting Inc. ("Fusion") into the DRI system. The effort to adapt the Fusion technology for DRI's application continued throughout 1999, but was ultimately abandoned as unsuitable.

5. In late 1999, DRI then began development of its own proprietary plasma lamp design with the assistance of Ceravision Limited, based in Escondido, California. DRI's plasma lamp design is described, for example, in Figures 4.12 and 4.21 of U.S. provisional application Serial No. 60/192,731, filed March 27, 2000.

6. At about the same time, my co-workers and I also began work in parallel to develop an alternative plasma lamp system based on waveguide principles, which I refer to herein as a "waveguide lamp system." The waveguide lamp system is described and claimed in the present patent application, and shares many common features with DRI's first generation plasma lamp design, including the use of a ceramic cavity containing a metal halide and sapphire window to avoid the devitrification phenomenon observed with quartz bulbs. In addition, it was believed that by using the ceramic lamp cavity as a waveguide, the efficiency of the lamp could be enhanced.

7. The present invention was conceived at a meeting held on October 25, 1999, and attended by me, Ed Sandberg and David Smoler. We initially discussed using an air waveguide to excite the plasma in the lamp, but rejected this approach as impractical because the physical dimensions

of the waveguide would have been too large at the desired operating frequencies. We realized during the course of our further discussions that using a ceramic waveguide would permit reduction of the size of the waveguide by a factor of the dielectric constant of ceramic. We agreed at that meeting that the waveguide lamp design was inventive, and should be the subject of continued development.

8. DRI continued the development of its first generation plasma lamp with the goal of applying the techniques learned from that design to the more elegant waveguide lamp system. Due to a family illness, Mr. Smoler resigned as a consultant in January 2000, and no longer participated in the DRI development work. Despite Mr. Smoler's absence, however, DRI continued to work on various aspects of the plasma lamp development, including methods of joining a sapphire window to a solid ceramic package, shaping the RF field produced by the antenna, and integration of the RF electronics with the lamp package.

9. In March of 2000, I was introduced by Jim Legge, DRI's Vice-President of Manufacturing, to David Turner and his engineering consulting company, Turner Engineering Inc. ("TENCO"). DRI initially retained TENCO to provide assistance with electronics components of the plasma lamp system. DRI and TENCO negotiated a Statement of Work and Engineering Services Agreement ("ESA") for this work, a draft of which is attached to this declaration as Exhibit 1. Because many of the DRI records were lost when DRI filed for bankruptcy in March 2002, I have included herewith such copies of the documents as are presently available to the current assignee of the present application, Ceravision Limited. Pursuant to the ESA, all of DRI's designs and other technical information regarding its plasma lamp and waveguide lamp

system were to remain DRI's property, and all work performed by TENCO under the agreement for which DRI paid TENCO also was to be the property of DRI.

10. In addition to the electronics work, DRI also disclosed the waveguide lamp system to TENCO and its related company, Betadot. These disclosures occurred on and before April 11, 2000, and led to an expansion of the scope of the ESA between DRI and TENCO, with TENCO further assisting in implementing the waveguide lamp system designs developed by DRI. Matthew Espiau and Chandrashekar Joshi participated in this work on behalf of TENCO and Betadot.

11. I recall attending several meetings with Mr. Turner, Mr. Espiau, Mr. Ken Gold and Mr. Joshi at which DRI provided TENCO with copies of DRI's waveguide lamp designs. Under the expanded ESA, TENCO and Betadot were to conduct simulations on the DRI designs and report the results back to DRI. DRI also provided physical parts to TENCO for the simulation testing and prototype development. TENCO completed the work they were asked to do in about July 2000. TENCO was paid in full for its work under the ESA.

12. In connection with the work performed under the ESA, DRI and TENCO engineers worked closely together, and TENCO was given full access to the DRI waveguide lamp designs. Within weeks of the expansion of the ESA, Mr. Guthrie had generated and transmitted to TENCO a series of waveguide lamp designs. Several of the drawings prepared by Mr. Guthrie and transmitted to TENCO, including Mr. Espiau and Mr. Joshi, are attached to this declaration as Exhibits 2-5.

13. By June 26, 2000, a working prototype of the waveguide lamp was operating at a frequency of 10 GHz, as reported in Mr. Turner's e-mail message. Although the prototype was not production ready, it clearly demonstrated

proof of concept of DRI's waveguide lamp invention. A copy of Mr. Turner's message is attached to this declaration as Exhibit 6.

14. Satisfied that the waveguide lamp system was a viable invention, it was also about this time that Mr. Guthrie was directed to prepare a submission to DRI's patent attorney describing DRI's waveguide lamp invention. Based on discussions with myself and Mr. Sandberg, Mr. Guthrie prepared an invention disclosure memorializing the October 25, 1999 conception of the waveguide lamp invention. A portion of that patent disclosure summary is attached to this declaration as Exhibit 7. Exhibit 7 was transmitted to DRI's patent counsel, and resulted in the filing of U.S. provisional patent application Serial No. 60/224,298 on August 10, 2000. A copy of that provisional application is attached to this declaration as Exhibit 8.

15. By mid-July 2000, Mr. Catlett of DRI and Mr. Turner had begun discussions regarding formation of a possible joint venture between DRI and TENCO to commercialize the waveguide lamp system. However, Mr. Turner demanded a stake in the company disproportionate to TENCO's work under the ESA, and relationships between the companies soured. By late July 2000, TENCO (which had by this time changed its name to Luxim Corporation) severed all further interactions with DRI. Based on the ESA, it is my understanding that DRI retained ownership to all aspects of the waveguide lamp work performed by TENCO.

16. I understand that the claims of the present patent application have been rejected as anticipated by U.S. Patent Application Publication No. US 2002/0011802, which has issued as U.S. Patent No. 6,737,809 ("the '809 patent"). I understand that the '809 patent claims to be based on a provisional patent application filed on July 31, 2000. This

was the very time that TENCO was demanding an unreasonable stake in the proposed DRI-TENCO joint venture to commercialize the device, and when the relationship between the companies was about to be severed.

17. I have reviewed the '809 patent, and specifically claim 1 of that patent. That claim is directed to exactly the waveguide lamp system that DRI first designed and owned, and TENCO assisted in implementing, under the ESA. More specifically, DRI invented a ceramic waveguide having a cavity filled with gas and forming a light emitting plasma, dimensioned to have at least one resonant mode, and coupled to an RF antenna. Moreover, as indicated in Exhibit 6, the RF source operated at 10 GHz, within the claimed frequency range recited in claim 1 of the '809 patent.

18. In my opinion, the invention recited in claim 1 of the '809 patent was not invented by any of the inventors listed on that patent. Instead, I believe that invention was invented by my colleagues and I at DRI before TENCO, Mr. Espiau or Mr. Joshi ever heard of DRI. Finally, to the extent that anyone at TENCO, Mr. Espiau or Mr. Joshi alleges he made an invention relating to waveguide lamp systems prior to July 2000, I believe that such invention (whether or not patentable) was the property of DRI and should have been assigned to DRI under the ESA.

I declare the following to be true and correct under penalty of perjury under the laws of the State of California this 22 day of November at San Jose, California.

Gregory Alan Prior

T U R N E R
E N G I N E E R I N G
C O M P A N Y

To:	Mr. Greg Prior Digital Reflection, Inc.	March 31, 2000 Ref.:	TN - 118
Fax No:	408 399-6937	Total Pages: 8 Including This Page	
From:	David Turner		
Project:	Production Engineering for DRI Components		
Subject:	Turner Engineering Company Proposal to Provide Production Engineering		

Dear Greg,

Thanks for the introduction to the Digital Reflection product and development status and the update today. The demo units in your conference room show that the work you've done has brought you close to the production stage.

You pointed out some areas where you need solutions to enable initial production volumes, targeting the Christmas season this year. We at Turner Engineering Company (Tenco) have organized a team with the resources and experience to help in two areas:

- Analog Characterization / Problem Resolution
- Development of a packaged excited and plasma lamp.

In addition, we are trying to find a reasonable development path for the DAC ASIC. Please send or email me the specification for the DAC ASIC. I've separately faxed the signed Non-Disclosure Agreement to Jim Legge.

I'll briefly describe our resources and approach for the two developments. In areas where our approach looks good to you, we are ready to get started, meet with you again, see your product specifications and schedule, and move forward.

Analog Characterization / Problem Resolution

Requirement: DRI has found certain analog problem conditions which need analysis and design modification.

Team and Experience: Mr. Ken Gold, with Tenco, will analyze and understand the analog problems and provide design modifications to resolve them. Ken is an outstanding electronics design engineer, whose design s provide peak performance and exceptional reliability in challenging applications. His extensive experience spans the electronic engineering field, and include precise analog designs, phase-lock loops, network communication interfaces, instrumentation, and servos, as well as system design and high-speed high-density digital circuits. His projects include audio, video, magnetic disk, transit, automotive diagnostic, banking, manufacturing, and test applications.

Approach: We will start the work at DRI, where the analog behavior problem can be studied on the operating equipment. Ken Gold is available to come Wednesday morning, once we get your notice to proceed. We will understand the exact behavior that is causing the problem, and provide one or more design alternatives to resolve it. We will prototype the fix, or work with you to get it done, and demonstrate that the problem is solved.

Packaged Exciter / Plasma Lamp

Requirement: DR needs a packaged exciter and plasma lamp light source. The target price for the one cubic inch combined device is $20 in high volume. The requirement is for a 125 w output, 1.0 GHz exciter. DC power for the lamp package is from a transformer supply external to the lamp package. The rf power to the plasma lamp should be stabilized to account for load and starting variations, and should be stable to at least +/- 10 MHz.

Team and Experience: Tenco and BetaDot will work together to develop and provide the plasma lamp package. BetaDot is a product development business bringing together leading scientists and engineers with extensive experience in research, development, and application of high frequency electronics devices and systems, as well as plasma physics, high energy lasers, and advanced communications. Dr. Chan Joshi, Professor of Electrical Engineering and Director of the Center for High Frequency Electronics at UCLA and R&D Director of BetaDot, will direct the electrical design. Mr. Don Mullen, with Tenco, is a senior mechanical engineer who lives in Mountain View. He has worked on high performance cooling solutions for supercomputers, medical equipment, and consumer PC electronics. He has extensive experience with heat pipes, ceramics, and productization enabling production of low cost, high reliability, high performance electronics in volumes of millions.

Approach: The biggest challenges in this task are minimizing the amount of waste heat generation, getting the heat out, and controlling the exciter power supply to match the characteristics of the plasma during startup and warmup. DRI is presently working on the problem of sealing the sapphire lens to the ceramic plasma lamp package. We will fit the exciter electrical design, consisting of feedback controller, oscillator, medium and high power stages, to the lamp you are developing, initially using prototype quartz lamps you give us.

We suggest a three step approach, with a proof of concept model in six to eight weeks, a form-fit-function prototype in about two more months, and pre-production units at the next step following your approval. Tenco will coordinate exciter package design with the ongoing lamp activities.

For the plasma lamp / exciter package, we can work under a business model in which we provide you a complete design and production support service on a contract basis, or a turnkey manufacturing operation in which we deliver finished products.

I've attached our usual Engineering Service Agreement, along with a Statement of Work covering the first engineering task. If it's suitable, we're ready to start work as soon as Ken Gold can get up there, either Monday or Wednesday.

I'll be in touch to discuss these design approaches and next steps. We will work with you and help make these products a success. Please call me at (310) 915-7601, fax me at (310) 390-4742, or email me at "DTurner@ieee.org", with any instructions, questions, or comments.

Sincerely yours,

David Turner

Engineering Service Agreement

AGREEMENT, made as of the date signed below by Digital Reflection, Inc. (Client) and Turner Engineering Company, (Tenco).

Client and Tenco make this Agreement for Tenco to provide engineering services to Client pursuant to Clients' video technology projects.

Client and Tenco agree as follows:

1 Scope of Work

Client shall request work using a Statement of Work form signed by both Tenco and Client. The completed Statement of Work form shall become a part of this agreement.

2 Conduct of Work

Tenco shall perform the work as requested by Client in an executed SOW. Tenco shall perform the work at Client's facilities in Los Gatos, CA, at Tenco's facilities in Venice, CA, or at another mutually agreed place.

Tenco is as an independent contractor, not an employee of Client.

3 Payment

a) Client shall pay Tenco for work performed by Tenco staff, associates, and subcontractors covered by any Statement of Work under this Agreement, per the rates listed on Exhibit 1, Tenco Product Engineering Rates. Travel time in conduct of the work shall be charged.

b) Client shall reimburse Tenco for travel and other ordinary and necessary expenses incurred in the conduct of the work.

c) Tenco shall submit an invoice on a monthly basis.

d) Client shall pay Tenco within 10 days of Client receipt of Tenco's invoice for services and expenses.

4 Warranty

Tenco warrants that it will use its best professional efforts in the conduct of this work.

5 Products and Documents

All Client designs, drawings, and other technical information ("Technical Information") relating to the services, and the intellectual property rights therein shall be and remain the property of Client.

For all Client's Technical Information marked "proprietary" or "confidential", such Technical Information shall be kept confidential by Tenco, its employees, agents, or subcontractors, and shall not be copied or disclosed by any of them and shall not be used by them other than for the purposes of performing Client work under this agreement. On termination of this agreement, Tenco shall return to Client all such Technical Information supplied by Client, together with any copies made, except that Tenco shall keep a file copy solely for business records purposes.

The separate Bilateral Non-Disclosure Agreement ("BNDA") executed between Tenco and Client is incorporated into this document by reference. All work performed under this Agreement shall be subject to the terms of the BNDA.

Work performed under this agreement for which Client has paid Tenco which is not based on proprietary information of Tenco is the property of Client.

6 Termination

This agreement shall terminate one day after the latest of completion of the work defined in the Scope of Work section; or one year after the date above. In addition, Client shall have the right to issue a written instruction to Tenco to stop work and terminate this agreement at its convenience. Tenco shall stop work on receipt of Client's notice, and Client shall pay Tenco for all work performed prior to Tenco receipt of a stop work notice.

7 Third Parties

Tenco and Client represent that each has full authority to enter into this agreement, and that each has no contractual obligations with third parties in conflict herewith.

8 Arbitration

Any controversy or claim arising out of or relating to this Agreement shall be settled by arbitration in accordance with the rules of the American Arbitration Association and judgement on the award rendered by the arbitrator may be entered in any court having jurisdiction thereof. Either party to this Agreement may submit to arbitration any said controversy or claim.

9 Attorney Fees

In any action at law or in equity to enforce or interpret the terms of this Agreement, or the defense to which is a provision of this Agreement, the prevailing party shall be entitled to

recover reasonable attorney fees, costs and necessary disbursements arising from such dispute.

10 Notice

Notices required or permitted to be given under this agreement may be delivered personally to an officer of the party to be notified, or sent by mail, facsimile, or courier.

11 Promotion

Either party may disclose and publicize the fact that Tenco is providing engineering service for Client and describe the general nature of the work it is performing, provided however, that Tenco's disclosure shall not violate the restrictions on Technical Information in the Products and Documents section.

12 California Law

This contract shall be governed by the laws of the state of California.

IN WITNESS WHEREOF, the parties hereto have executed this agreement as of the day and year first above written.

Agreed

By:	By:
(signature)	(signature)
	David Turner
(name)	
Digital Reflection, Inc. 644 University Avenue Los Gatos, CA 95032	Turner Engineering Company 2006 Glyndon Avenue Venice, CA 90291
Date:	Date:

Statement of Work
Number DRI-00-01

For: Digital Reflection, Inc.

Project: Provide engineering support per DRI direction.

Task: 1] Per direction from DRI, analyze analog behavior problems on operating equipment at DRI, provide one or more design alternatives to resolve it, prototype the fix, or work with DRI to get it done, and demonstrate that the problem is solved.

2] Per direction from DRI, provide design study for plasma lamp exciter and package.

Period: April 3 – Ma y 1, 2000. All dates are relative to actual SOW start date.

Budget Limit: Tenco expenditures shall not exceed the budget limit of $20,000 without written authorization from DRI.

Agreed

By:	By:
_____	_____
(signature)	(signature)
	David Turner
_____	
(name)	
Digital Reflection, Inc. 644 University Avenue Los Gatos, CA 95032	Turner Engineering Company 2006 Glyndon Avenue Venice, CA 90291
Date:	Date:
_____	_____

T U R N E R

E N G I N E E R I N G
C O M P A N Y

Tenco FY 2000
Product Engineering Rates

Staff	Rate/Hr
Principal Technologist	$145
Senior Engineer	$125
Staff Engineer, Senior Designer	$ 95
Engineer, Designer, Senior Tech	$ 75
Technician, Clerk	$ 55

Charles Guthrie

From: "David Turner" <DTurner@att.net>
To: "Wayne Catlett" <fwc@digital-reflection.com>
Cc: "Greg Prior" <gap@digital-reflection.com>; "Jim Legge" <jtl@digital-reflection.com>; "Don Wilson" <dwilson77@home.com>; "Charles Guthrie" <clguthr@home.com>; "Chan Joshi" <joshi@ee.ucla.edu>; "Matt Espiau" <espiau@ee.ucla.edu>; "Yian Chang" <ian@ychang.com>; "Don Mullen" <dmullen@rambus.com>
Sent: Monday, June 26, 2000 6:25 PM
Attach: DTurner.vcf
Subject: Luxim Waveguide Status and Meeting

Hi Wayne,

We'd like to update you on the waveguide status since we met last week.

Experiments:

We went through several more cycles of adjusting the resonant cavity, and got to a configuration where virtually all the 10 GHz power is transferred to the resonant cavity, with almost no reflection. In that condition, we used the calibrated photometer results to calculate we had a light output of about 3800 lumens in 4*pi steradians (a sphere). This is for an input power of 77 W.

With the improved resonant cavity, we could switch the lamp on and off with the flip of a switch. When it was cold, it takes about thirty seconds to melt the halide and go from blue to white, but when the lamp is warm, it switches on and off instantly.

There are signs that we are driving the mixture too hard, and that the light is turning blue. Of course, this is a 'sample of one', and we don't know yet about how the intensity, color, and efficiency characteristics of the light vary with the parameters we need to dynamically and statically control, such as input power, gas pressure, mass of halide metal, etc.

Material Samples and Equipment

Tina Alton ordered the Kyocera samples. We're going to order another set of samples directly from here, as soon as we receive the expense deposit account.

We were told that the low frequency isolator and terminator is being shipped to us this week. We'll use it in the test setup at 1 GHz.

Meeting

We're meeting with Don and Charles at UCLA on Tuesday. Agenda:

1] Schedule review and markup - send to Sheena

2] Status of test setup and results

3] Test samples

4] Lamp sealing

5] Next steps

We'll appreciate any comments.

Best regards, David

--
David Turner
Turner Engineering Company
2006 Glyndon Avenue
Venice, CA 90291
ph 310 915-7601
fx 310 390-4742

1.) Patent Disclosure Summary

Invention Title: ***A Wave Guide used for the excitation of an electrode-less metal Halide Plasma Lamp incorporating a solid dielectric material***
Inventors: Greg Prior, David Smolner, Tim Russell, & Ed Sandberg
Date of the Invention: October 25, 1999

2.) Brief Description of the invention – In attempting to develop an electrode-less Metal Halide lamp, considerations must be taken as to how to drive the lamp with R. F. power while maintaining a high level of efficiency, control over R. F. emissions, and a package size suitable for most lamp applications. One of the considerations presented in the following discussion is the use of a solid ceramic dielectric material to replace the air dielectric commonly used in R. F. applications, in order to reduce the size and weight of the integrated R. F. Wave-guide and Lamp.

The proposed invention takes into account all of these claims while providing a light source of considerable brightness, extreme electrical efficiency, and unprecedented life capabilities. The lamp is light in weight, compact in size, and extremely rugged when placed into any operating environment.

Several considerations are made concerning the choice of a suitable dielectric material for the construction of the invention. First an understanding of the technology using air as a dielectric is necessary in order to develop suitable parameters for the wave-guide.

Using a known air guide structure, such as a WR975 wave-guide, it can be determined the approximate dimensions necessary to build a successful electrode-less lamp integrated into the wave-guide package, and having the characteristics of a ceramic metal halide lamp.

In understanding the parameters of the WR 975 wave-guide, we find that it has a cut off frequency of (f_c) = 605 MHz; an operating frequency of between 0.75 GHz. and 1.12 GHz.; a width and height of 9.75 inches by 4.875 inches. Assuming an operating frequency of 900 MHz., an air cavity would have a length between the antenna and lamp of approximately 13.1 inches.

If one used Alumina for the dielectric, the Alumina has a dielectric constant of approximately 9. By dividing the above dimensions for the

WR975 wave-guide by the square root of the dielectric constant, we find that the dimensions of a solid state wave guide using Alumina would have the approximate dimensions of 3.25 (A) inches by 1.625 (B) inches by 4.367 (C) inches respectively. This ceramic cavity is still too large for our lamp and would have an issue with weight.

By using a material that has a dielectric constant of 70, we further reduce the dimensions as follows: 1.16 inches (A) by 0.583 (B) inches by 1.566 inches (C) respectively. We have identified materials that fall within this range and appear to be stable over the operating temperature range of the lamp.

Further reductions in the size of the lamp could be accomplished by using materials with a dielectric constant of approximately 100. The dimensions of this cavity would be approximately 0.975 inches (A) by 0.4875 (B) inches by 1.31inches (C). Materials are available in this range and will be tested in the future.

Other materials will be considered in the future.

3.) **Background of the Invention Prior Art** – The use of wave-guides as an enclosure for R. F. power is a known technology. Likewise, the use of R. F. energy to fire a metal halide lamp is a known technology. In addition, the concept of an electrode-less lamp has been noted in the literature. However, the combination of all of these technologies into a compact package is a novel and previously unreported idea that combines all of the above technologies.

4.) **Attachments – DRI Drawing Wave Guide Concept 4.dwg**

8-11-00

A / Prov.

PROVISIONAL PATENT APPLICATION TRANSMITTAL

This is a request for filing a PROVISIONAL APPLICATION under 37 CFR 1.53(b)(2).

Docket Number	DGTL-1800	Type a plus sign (+) inside this box ->	+

INVENTOR(s)/APPLICANT(s)	
FIRST NAME, MIDDLE INITIAL, LAST NAME	RESIDENCE (CITY AND EITHER STATE OR FOREIGN COUNTRY)
1. Greg Prior	Los Gatos, California
2. David Smoler	Los Gatos, California
3. Tim Russell	Los Gatos, California
4. Edmund Sandberg	Los Gatos, California
5.	

TITLE OF THE INVENTION (280 characters max)

A WAVE-GUIDE USED FOR THE EXCITATION OF AN ELECTRODE-LESS METAL HALIDE PLASMA LAMP INCORPORATING A SOLID DIELECTRIC MATERIAL

CORRESPONDENCE ADDRESS

Eric N. Hoover
Limbach & Limbach L.L.P.
2001 Ferry Building
San Francisco
Phone: 415/433-4150; Fax: 415/433-8716

STATE	CA	ZIP CODE	94111-4262	COUNTRY	U.S.A.

ENCLOSED APPLICATION PARTS *(check all that apply)*

X	Specification *Number of Pages*	2		X	Small Entity Statement
X	Drawing(s) *Number of Sheets*	1			Other (specify):

METHOD OF PAYMENT *(check one)*

X	A check or money order is enclosed to cover the Provisional filing fees.	PROVISIONAL FILING FEE AMOUNT(S)	$75.00
X	The Commissioner is hereby authorized to charge any additional filing fees and credit Deposit Account Number: 12-1420		

The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government

X	No.
	Yes, the name of the U.S. Government agency and the Government contract number are:

Respectfully submitted,

SIGNATURE: Eric Hoover Date: 8/10/00

TYPED or PRINTED NAME: Eric N. Hoover REGISTRATION NO. *(if appropriate)*: 37,355

CERTIFICATION UNDER 37 CFR §1.10

I hereby certify that this New Provisional Application and the documents referred to as enclosed herein are being deposited with the United States Postal Service on this date August 10, 2000, in an envelope bearing "Express Mail Post Office To Addressee" Mailing Label Number EL254065726US addressed to: Box Provisional Patent Application, Assistant Commissioner for Patents, Washington, D.C. 20231.

SIGNATURE: LANA T. BRENNER Date:

Applicant or Patentee: Greg Prior, et al Attorney's
Appln. or Patent No.: Docket No.: DGTL-1800
Filed or Issued:
For: A WAVE-GUIDE USED FOR THE EXCITATION OF AN ELECTRODE-LESS METAL HALIDE PLASMA LAMP INCORPORATING A SOLID DIELECTRIC MATERIAL

Express Mail Number EL254065725US

VERIFIED STATEMENT (DECLARATION) CLAIMING SMALL ENTITY STATUS (37 CFR 1.9(f) and 1.27(c)) - SMALL BUSINESS CONCERN

I hereby declare that I am
[ ] the owner of the small business concern identified below:
[XX] an official of the small business concern empowered to act on behalf of the concern identified below:

NAME OF CONCERN Digital Reflection
ADDRESS OF CONCERN 644 University Ave., Los Gatos, CA 95032

I hereby declare that the above identified small business concern qualifies as a small business concern as defined in 13 CFR 121.3-18, and reproduced in 37 CFR 1.9(d), for purposes of paying reduced fees under section 41(a) and (b) of Title 35, United States Code, in that the number of employees of the concern, including those of its affiliates, does not exceed 500 persons. For purposes of this statement, (1) the number of employees of the business concern is the average over the previous fiscal year of the concern of the persons employed on a full-time, part-time or temporary basis during each of the pay periods of the fiscal year, and (2) concerns are affiliates of each other when either, directly or indirectly, one concern controls or has the power to control the other, or a third party or parties controls or has the power to control both.

I hereby declare that rights under contract or law have been conveyed to and remain with the small business concern identified above with regard to the invention, entitled A WAVE-GUIDE USED FOR THE EXCITATION OF AN ELECTRODE-LESS METAL HALIDE PLASMA LAMP INCORPORATING A SOLID DIELECTRIC MATERIAL

[XX] the specification filed herewith with title as listed above.
[ ] application no. _____, filed _____.
[ ] patent no. _____, issued _____.

If the rights held by the above identified small business concern are not exclusive, each individual, concern or organization having rights to the invention is listed below* and no rights to the invention are held by any person, other than the inventor, who could not qualify as an independent inventor under 37 CFR 1.9(c) if that person made the invention, or by any concern which would not qualify as a small business concern under 37 CFR 1.9(d) or a nonprofit organization under 37 CFR 1.9(e).

*NOTE: Separate verified statements are required from each named person, concern or organization having rights to the invention averring to their status as small entities. (37 CFR 1.27).

NAME ____
ADDRESS _
[ ] Individual [ ] Small Business Concern [ ] Nonprofit Organization

NAME ____
ADDRESS _
[ ] Individual [ ] Small Business Concern [ ] Nonprofit Organization

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time or paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28(b))

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like to made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

NAME OF PERSON SIGNING Arthur Berman
TITLE OF PERSON OTHER THAN OWNER Manager of Liquid Crystal Operations
ADDRESS OF PERSON SIGNING 644 University Ave., Los Gatos, CA 95032

SIGNATURE: _____ DATE: 06-08-00

1. Patent Disclosure Summary

Invention Title: A Wave-guide used for the Excitation of an Electrode-less Metal Halide Plasma Lamp Incorporating a Solid Dielectric Material

Inventors: Greg Prior, David Smoler, Tim Russell and Edmund Sandberg

2. Brief Description of the Inventions

This invention relates to an electrode-less metal halide lamp that is embedded within a wave-guide structure. More specifically, a means is disclosed by which it is possible to drive the lamp with Radio Frequency (R.F.) power while at the same time:

- Maintaining a high level of efficiency.
- Controlling R.F. emissions.
- Producing a package size that is suitable for real lamp applications.

Note that, as discussed below, approaches based on the use of a material with a high dielectric constant in a wave-guide application is a known technology. The use of such a system in an integrated lamp/wave-guide package is, however, new and novel and the intended focus of this disclosure.

3. Background of the Invention and Prior Art

In conventional R.F. wave-guide applications, air is used as the dielectric. Consider a specific example making reference to Figure #3.1. Using a known air guide structure, such as a WR975 wave-guide, it is possible to determine the approximate dimensions necessary to build a successful electrode-less lamp that is integrated into the wave-guide package and that has the characteristics of a ceramic metal halide lamp.

It is known that the WR975 wave-guide has a cut off frequency of (f_c) = 605 mHz; an operating frequency of between 0.75 gHz and 1.12 gHz; a width and height of 9.75" by 4.875". If we assume an operating frequency of 900 mHz, an air cavity would have a length between the antenna and lamp of approximately 13.1". This is physically too large for a practical electrode-less lamp application. The invention discussed below addresses this problem.

4. Description and Discussion of the Preferred Embodiments of the Inventions

The invention is to use of a solid ceramic dielectric material to replace the air dielectric. It will serve to reduce the size and weight of the integrated R.F. wave-guide and lamp. Several considerations are involved in selecting a suitable dielectric material. Among these is the dielectric constant of the ceramic material.

Consider the use of alumina as the dielectric. It has a dielectric constant of approximately 9. By dividing the above dimensions of the WR975 wave-guide by the square root of the dielectric constant, the dimensions of the resulting solid state wave guide would be approximately 3.25"

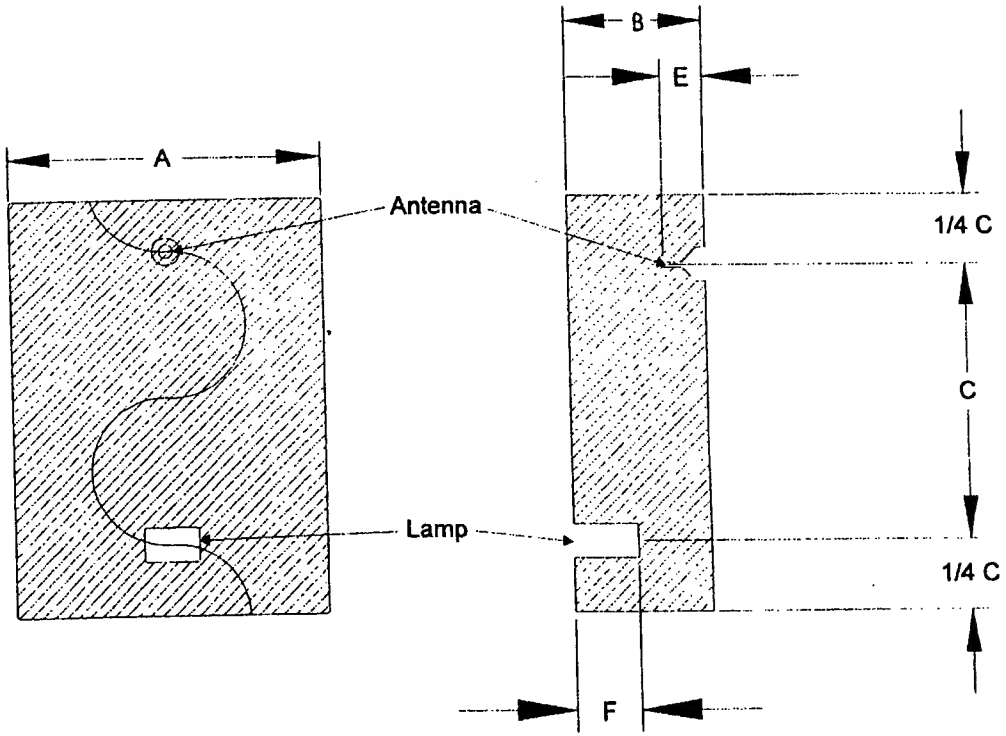
(A) by 1.625" (B) by 4.367" (C). Although a considerable improvement, this ceramic cavity would still be too large and heavy for the lamp desired by Digital Reflection.

Consider next the use of a material that has a dielectric constant of 70. The dimensions would be reduced to the following: 1.16" (A) by 0.583" (B) by 1.566" (C). Materials have been identified that fall within this range and that appear to be stable over the operating temperature range of the lamp.

Further reductions in the size of the lamp could be accomplished by using materials with a dielectric constant of approximately 100. The dimensions of such a cavity would be approximately 0.975" (A) by 0.4875" (B) by 1.31" (C).

The light source designed with such a high dielectric ceramic would have considerable brightness, extreme electrical efficiency and unprecedented lifetime. The lamp would be lightweight, compact in size, and extremely rugged.

FIGURE #3.1: WAVE GUIDE LAMP CONCEPT 4



Notes:
1.) Waveguide is made of a ceramic material
2.) Dimensions A, B, and C are dependent on the operating frequency, the wave guide cut off frequency, and the dielectric constant of the ceramic material.
3.) Dimension E & F are determined by the frequency of the R. F. Power entering the wave guide.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants	:	Charles Guthrie et al.
Serial No.	:	09/818,092
Filed	:	March 26, 2001
For	:	High Intensity Light Source
Examiner	:	Benny T. Lee
Group Art Unit	:	2817

Mail Stop
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

DECLARATION OF EDMUND SANDBERG
UNDER 37 C.F.R. § 41.202(a)

I, Edmund Sandberg, declare:

1. I am a resident of the State of California, having a home address of 17990 Rose Court, Monte Sereno, California, 95030.

2. I make this declaration to describe my participation in the development of the invention described and claimed in the above-identified patent application.

3. I was Principle Scientist at Digital Reflection, Inc. ("DRI") from Oct. 1998 to June 15, 2001. In 1998, I worked closely with Greg Prior, DRI's Vice-President of Engineering, on optical and illumination components for LCOS display systems intended for high definition televisions then under development at DRI.

4. In connection with that work, DRI conducted an investigation to identify a suitable light source to illuminate the display system. DRI initially contacted ARC Inc. ("ARC"), which had developed a high pressure mercury lamp. We soon determined that the ARC lamp was impractical for the proposed application. We also contacted Fusion Lighting Inc. ("Fusion"), which had developed electrode-less lamps based on sulphur lamp technology and metal halide technology. For various reasons, we determined that the Fusion lamps also were unsuitable for display illumination.

5. As DRI faced the uncertain prospect of being unable to adapt any commercially available lamp technology for the proposed DRI application, we began discussing our options internally and considered developing our own plasma lamp system. Our internal discussions turned toward development of a lamp system in which plasma was excited using either an electrostatic or magnetic RF field. By early October 1999, Don Wilson had joined DRI and was working on the plasma lamp project as well. Figures 4.12 and 4.21 of U.S. provisional application Serial No. 60/192,731, filed March 27, 2000 describe some of the initial plasma lamp designs developed by Don Wilson and me in late 1999.

6. Also in late 1999, DRI began work on an alternative plasma lamp system based on waveguide principles. This system was referred to as the "waveguide lamp system" and is described and claimed in the present patent application. The waveguide lamp system shares many features with DRI's first generation plasma lamp design.

7. The present invention was conceived at a meeting held on October 25, 1999, and attended by me, Greg Prior and David Smoler, an external consultant. At this

meeting, it was suggested that a waveguide could be used to excite the plasma. Initially, we discussed using an air waveguide but rejected this approach because the physical dimensions of the waveguide would have been too large at the frequency we planned to use to excite the plasma.

8. Our further discussions lead to the suggestion to use a ceramic waveguide, because the dielectric constant of ceramic (which is greater than two) would enable reduction of the waveguide to a manageable size. As conceived, the waveguide would accommodate one full wave, with a RF antenna coupled at one end of the wave and a gas-filled bulb at the other end of the wave, whereby the wave would excite the gas in the bulb to form a plasma. Although RF waveguides were known, and the use of an RF field to ignite a metal halide lamp was known, we believed this combination of technologies to be inventive. A copy of the patent disclosure summary prepared later to memorialize the conception of the invention is attached to this declaration as Exhibit 1.

9. Due to family illness, David Smoler was no longer able to continue working for DRI and ceased work on the plasma lamp project in January 2000. Despite Mr. Smoler's absence, DRI continued to work on various aspects of its initial plasma lamp design, including methods of joining a sapphire window to a solid ceramic package, shaping the RF field produced by the antenna, and integration of the RF electronics with the lamp package. It was expected that the technical experience gained with this design could be readily transferred to the waveguide lamp system.

10. By March 2000, DRI began looking for consultants to assist it with the electronics to be used in the plasma lamp system. Jim Legge, DRI's Vice President of Manufacturing, introduced David Turner of Turner Engineering

Inc. ("TENCO") as a potential consultant for the production engineering of the electronics components.

12. I have reviewed Mr. Prior's declaration submitted herewith in support of the above-identified application, and his recitation of DRI's relationship with TENCO comports with my own recollection of those events. Specifically, it is my understanding that it was DRI personnel, including Mr. Prior, Mr. Wilson and Charles Guthrie who introduced the concept of a waveguide lamp system to TENCO. It is also my understanding that using DRI's designs, TENCO was able to build an operational prototype unit of the waveguide lamp system by late June 2000.

13. I am informed that the claims of the above-identified patent application have been rejected as anticipated by U.S. Patent Application Publication No. US 2002/0011802, now U.S. Patent No. 6,737,809 ("the '809 patent"). I understand that the '809 patent is based on a provisional patent application filed on July 31, 2000, shortly before DRI and TENCO severed their relationship.

14. I have reviewed claim 1 of the '809 patent. In my view, claim 1 covers the waveguide lamp system that was first invented by DRI and implemented by TENCO under its contract with DRI. The waveguide lamp system invented by Mr. Smoler, Mr. Prior and me (i) includes a ceramic waveguide having a cavity filled with gas that formed a light emitting plasma when energized, and (ii) was dimensioned to have at least one resonant mode and included an RF antenna for power delivery. All of these features are set forth in claim 1 of the '809 patent.

15. In my view, DRI invented the invention set forth in claim 1 of the '809 patent, not the "inventors" listed on that '809 patent. I do not believe that TENCO, Mr.

Espiau or Mr. Joshi had any involvement in the development of plasma lamps prior to the TENCO development work for DRI. Accordingly, I believe that it is unlikely that anyone at TENCO or Betadot could have conceived of the waveguide lamp system before DRI.

I declare the following to be true and correct under penalty of perjury under the laws of the State of California this 19 day of November at Monte Sereno, California.

Edmund Sandberg

2015933.1

1.) Patent Disclosure Summary

Invention Title: ***A Wave Guide used for the excitation of an electrode-less metal Halide Plasma Lamp incorporating a solid dielectric material***
Inventors: Greg Prior, David Smolner, Tim Russell, & Ed Sandberg
Date of the Invention: October 25, 1999

2.) Brief Description of the invention – In attempting to develop an electrode-less Metal Halide lamp, considerations must be taken as to how to drive the lamp with R. F. power while maintaining a high level of efficiency, control over R. F. emissions, and a package size suitable for most lamp applications. One of the considerations presented in the following discussion is the use of a solid ceramic dielectric material to replace the air dielectric commonly used in R. F. applications, in order to reduce the size and weight of the integrated R. F. Wave-guide and Lamp.

The proposed invention takes into account all of these claims while providing a light source of considerable brightness, extreme electrical efficiency, and unprecedented life capabilities. The lamp is light in weight, compact in size, and extremely rugged when placed into any operating environment.

Several considerations are made concerning the choice of a suitable dielectric material for the construction of the invention. First an understanding of the technology using air as a dielectric is necessary in order to develop suitable parameters for the wave-guide.

Using a known air guide structure, such as a WR975 wave-guide, it can be determined the approximate dimensions necessary to build a successful electrode-less lamp integrated into the wave-guide package, and having the characteristics of a ceramic metal halide lamp.

In understanding the parameters of the WR 975 wave-guide, we find that it has a cut off frequency of (f_c) = 605 MHz; an operating frequency of between 0.75 GHz. and 1.12 GHz.; a width and height of 9.75 inches by 4.875 inches. Assuming an operating frequency of 900 MHz., an air cavity would have a length between the antenna and lamp of approximately 13.1 inches.

If one used Alumina for the dielectric, the Alumina has a dielectric constant of approximately 9. By dividing the above dimensions for the

WR975 wave-guide by the square root of the dielectric constant, we find that the dimensions of a solid state wave guide using Alumina would have the approximate dimensions of 3.25 (A) inches by 1.625 (B) inches by 4.367 (C) inches respectively. This ceramic cavity is still too large for our lamp and would have an issue with weight.

By using a material that has a dielectric constant of 70, we further reduce the dimensions as follows: 1.16 inches (A) by 0.583 (B) inches by 1.566 inches (C) respectively. We have identified materials that fall within this range and appear to be stable over the operating temperature range of the lamp.

Further reductions in the size of the lamp could be accomplished by using materials with a dielectric constant of approximately 100. The dimensions of this cavity would be approximately 0.975 inches (A) by 0.4875 (B) inches by 1.31inches (C). Materials are available in this range and will be tested in the future.

Other materials will be considered in the future.

3.) **Background of the Invention Prior Art** – The use of wave-guides as an enclosure for R. F. power is a known technology. Likewise, the use of R. F. energy to fire a metal halide lamp is a known technology. In addition, the concept of an electrode-less lamp has been noted in the literature. However, the combination of all of these technologies into a compact package is a novel and previously unreported idea that combines all of the above technologies.

4.) **Attachments – DRI Drawing Wave Guide Concept 4.dwg**